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CCITT

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SERIES Q: SWITCHING AND SIGNALLING

Supplements to the Series Q Recommendations concerning Signalling Systems R1 and R2

LINE SIGNALLING FOR DC LINES WITH SYSTEM R2 INTERREGISTER SIGNALLING

Reedition of CCITT Recommendation Q.400, Supplement No. 1, published in the Blue Book, Fascicle VI.4 (1988)

NOTES

1 CCITT Recommendation Q.400 Supplement No. 1 was published in Fascicle VI.4 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Recommendation Q.400 Supplement No. 1

LINE SIGNALLING FOR DC LINES WITH SYSTEM R2 INTERREGISTER SIGNALLING

1 Introduction

In the following specification a line signalling system is defined for 2-wire, DC-lines with or without metering facility during speech.

The signalling polarity is provided by the incoming exchange and a loop is provided in the outgoing exchange, so that in case of cable fracture the outgoing exchange is informed automatically that the line(s) concerned is(are) no longer available.

The line signal repertoire is based on the presence of System R2 interregister signalling.

Apart from the metering pulses, the line signalling is continuous, which means that a certain state of a connection is characterized by a special signalling condition which is maintained as long as the indicated condition continues to exist.

The following states are provided:

Forward direction:

1) idle
2) seized
3) clear-forward

Backward direction:

1) available
2) seized before answer
3) answered[1]
4) metering[2]
5) clear-back[1]
6) forced release[2]
7) not available (blocking)

2 Principles of the signalling and speech circuit

2.1 *Signalling circuit*

An example of a signalling circuit is shown in Figure 1. Feeding of the loop occurs at the incoming exchange; the direction of the current can be reversed by contacts X and the feeding current can be switched off by contacts Tu. Contacts Bl are also used to switch off the feeding current and consequently, to block the circuit. This can only take place if the line circuit in the outgoing exchange is detected as being in the open or high resistance state.

When the contacts are in the position shown in the figure, normal loop current flows and when the contacts X are switched over reversed loop current flows.

In the outgoing exchange the state can be changed, by means of contact W, from the high resistance condition with the current-direction sensitive detector H switched in, to a state with two low resistance current-direction sensitive detectors L and R.

In addition to contact W a contact K is provided to open the loop; the open loop state is used to expedite the recognition of clear-forward.

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1 only without metering only with metering

2 only with metering

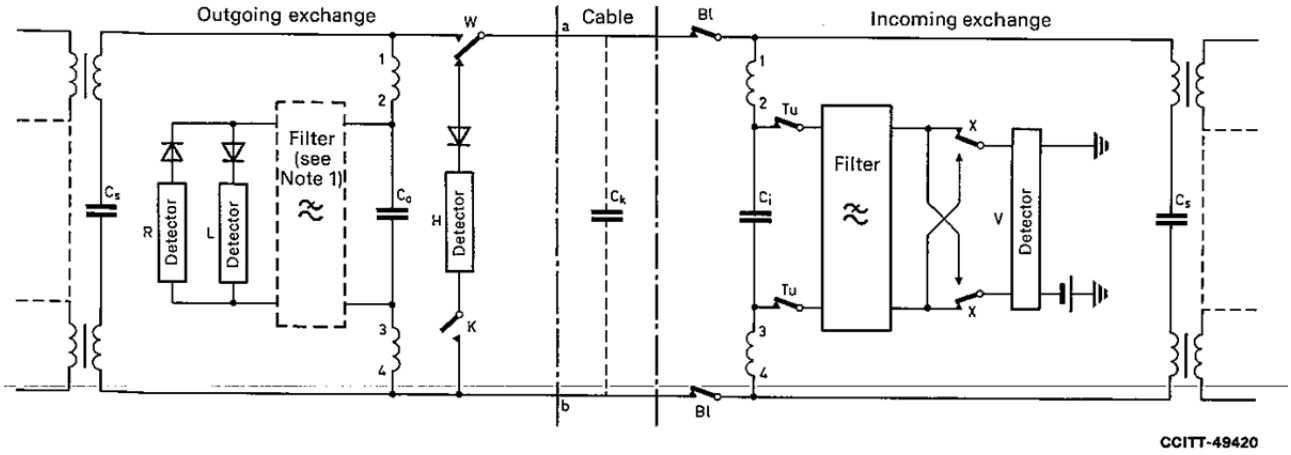
In the line circuit in the incoming exchange a filter is needed to provide sufficient attenuation in the audible components arising in case of polarity reversing. This is necessary, in particular, when metering pulses are sent during conversation.

In the line circuit in the outgoing exchange a filter may be needed to provide sufficient attenuation in the audible components arising when detectors L and R are operated and/or released. This filter, if required at all, can normally be much simpler than the one used in the incoming exchange.

2.2 *Speech circuit*

An example of a speech circuit is also shown in Figure 1. A circuit equipped with the loop signalling system concerned has to be electrically separated, from the preceding or following parts of the connection. This prevents interference by longitudinal voltages in other parts of the connection.

The detectors shall be of high impedance for speech.



Note 1 – This filter is optional.

Note 2 – The detector V and the contacts X for the reversal of the direction of the current may be interchanged.

FIGURE 1

Principle of the signalling and speech circuit

3 Meaning of the signalling states

In the Tables 1, 2 and 3 the meaning of the various signalling states are shown.

Outgoing exchange:

– high resistance = idle
– low resistance = seized
– open = clear-forward.

Incoming exchange (*without* metering):

– normal loop polarity = available, seized or clear-back
– reversed loop polarity = unavailable or answer
– no voltage = unavailable (blocking).

Incoming exchange (*with* metering):

– normal loop polarity = available or seized
– reversed loop polarity = unavailable or metering pulse
– no voltage = unavailable (blocking) or forced release.

4 Discrimination between the various signalling states

It is not necessary to be able to discriminate between each state of one end and all states of the other end. However, the capabilities shown in Tables 1, 2 and 3 should be provided.

TABLE 1

Outgoing exchange (*without* metering) is in state:	Outgoing exchange must be able to discriminate in the incoming exchange:	
high resistance	normal loop polarity	(available)
	reversed loop polarity or no voltage	(unavailable)
low resistance	reversed loop polarity	(answered)
	normal loop polarity	(seized, clear-back)

TABLE 2

Outgoing exchange (*with* metering) is in state:	Outgoing exchange must be able to discriminate in the incoming exchange:	
high resistance	normal loop polarity	(available)
	reversed loop polarity or no voltage	(unavailable)
low resistance	reversed loop polarity	(metering pulse)
	normal loop polarity	(seized)
	no voltage	(forced release)

TABLE 3

Incoming exchange is in state:	Incoming exchange must be able to discriminate in the outgoing exchange:	
normal loop polarity or reversed loop polarity	low resistance	(seized)
	high resistance open	(idle) (clear-forward)

5 **Operation** (see Figures 2a-2f)

5.1 In the idle state the line circuit in the outgoing exchange continuously checks whether or not the line is blocked by the high resistance detector H. This detector operates when the line is intact and the normal loop polarity is present in the incoming exchange indicating the state "available".

Detector V in the incoming exchange is marginal and does not operate in this state.

5.2 If the circuit in the outgoing exchange is seized for a call the exchange switches in the low resistance state and the low resistance detector L operates.

In the line circuit in the incoming exchange the detector V operates and the incoming equipment assumes the seized state.

5.3 *The B-subscriber answers*

a) *Without metering*

When the B-subscriber answers this is indicated by the line circuit in the incoming exchange by reversing the loop feeding polarity to reversed loop polarity. In the circuit in the outgoing exchange the low resistance detector R operates and L releases.

b) *With metering*

When the B-subscriber answers this is indicated by the incoming exchange (except in the case of a call that is free of charge) by sending a metering pulse. The incoming exchange sends a metering pulse by reversing the loop feeding polarity to reversed loop polarity during the metering pulse.

In the line circuit in the outgoing exchange the low resistance detector R operates and L releases.

5.4 The equipment must allow the following rules to be applied with respect to the sending of metering pulses.

– A metering pulse must be completed by the incoming exchange before sending forced release.

– After sending a metering pulse there is no minimum period with normal loop polarity before forced release is sent.

– During the receipt of a metering pulse the outgoing exchange is allowed to start sending clear-forward.

5.5 *Backward release*

a) *Without metering*

The incoming exchange can inform the outgoing exchange that the B-subscriber has cleared by sending clear-back. This signal consists in reversing the loop feeding polarity to normal loop polarity. In the line circuit of the outgoing exchange the low resistance detector L operates and R releases.

The incoming exchange remains in this state (clear-back) until the outgoing exchange sends clear-forward or the B-subscriber reanswers.

b) *With metering*

The incoming exchange can inform the outgoing exchange that the connection can be released by sending forced release. This signal, which consists in switching off the loop feeding potential, must persist for a minimum time T3. After receiving forced release the line circuit of the outgoing exchange must transmit clear-forward within a time T4 which is less than time T3.

Time T3 finishes when the line circuit in the incoming exchange is again available; normal loop polarity is then sent.

The above mentioned cleard-forward in the line circuit in the outgoing exchange is followed (just as in the case of the release without forced release described in § 5.6 by the idle state).

5.6 In order to release the circuit the outgoing exchange opens the loop (clear-forward) during a time T1, before switching in the high ohmic detector.

The incoming exchange must switch to one of the unavailable states within a time T2 which is less than T1, unless the circuit in this exchange is available before the time T2 has elapsed.

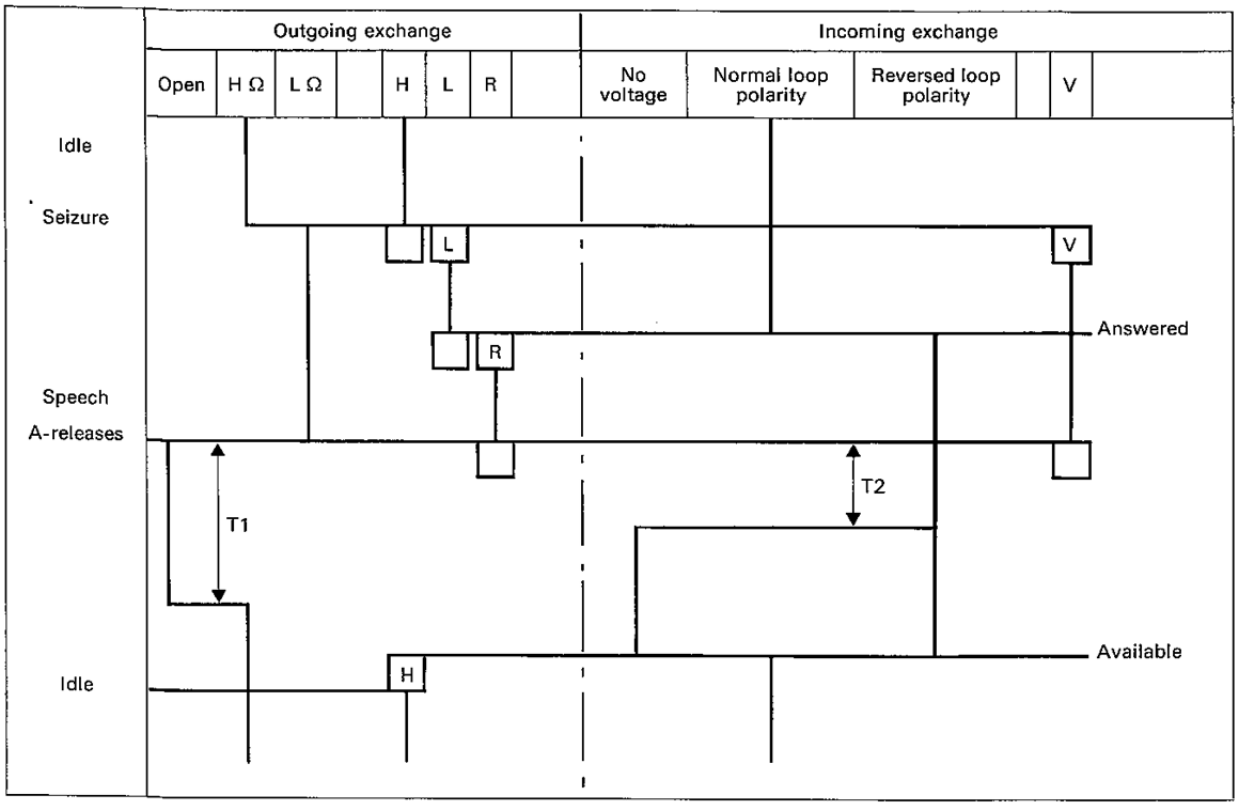
5.7 The incoming exchange can signal in two ways that it is not available for a new call, namely by reversing the loop or by switching off the feeding potentials.

In so far as the unavailability of the line circuit in the incoming exchange forms part of normal operation, this state should be indicated by reversed loop polarity.

Unavailability of the line circuit in the incoming exchange for other reasons should be indicated by switching off the feeding potentials.

5.8 If during the seized state of the line circuit in the outgoing exchange, the circuit is interrupted by disturbances or by the feeding potential being switched off, the outgoing exchange has to react to it in the same way as it does to clear-back (without metering) or forced release (with metering), possibly followed by blocking.

5.9 At the incoming exchange during the unavailable state and for a subsequent period of 100 ms during the available state, operation of detector V should be ineffective.



a) A-subscriber releases first (without metering)

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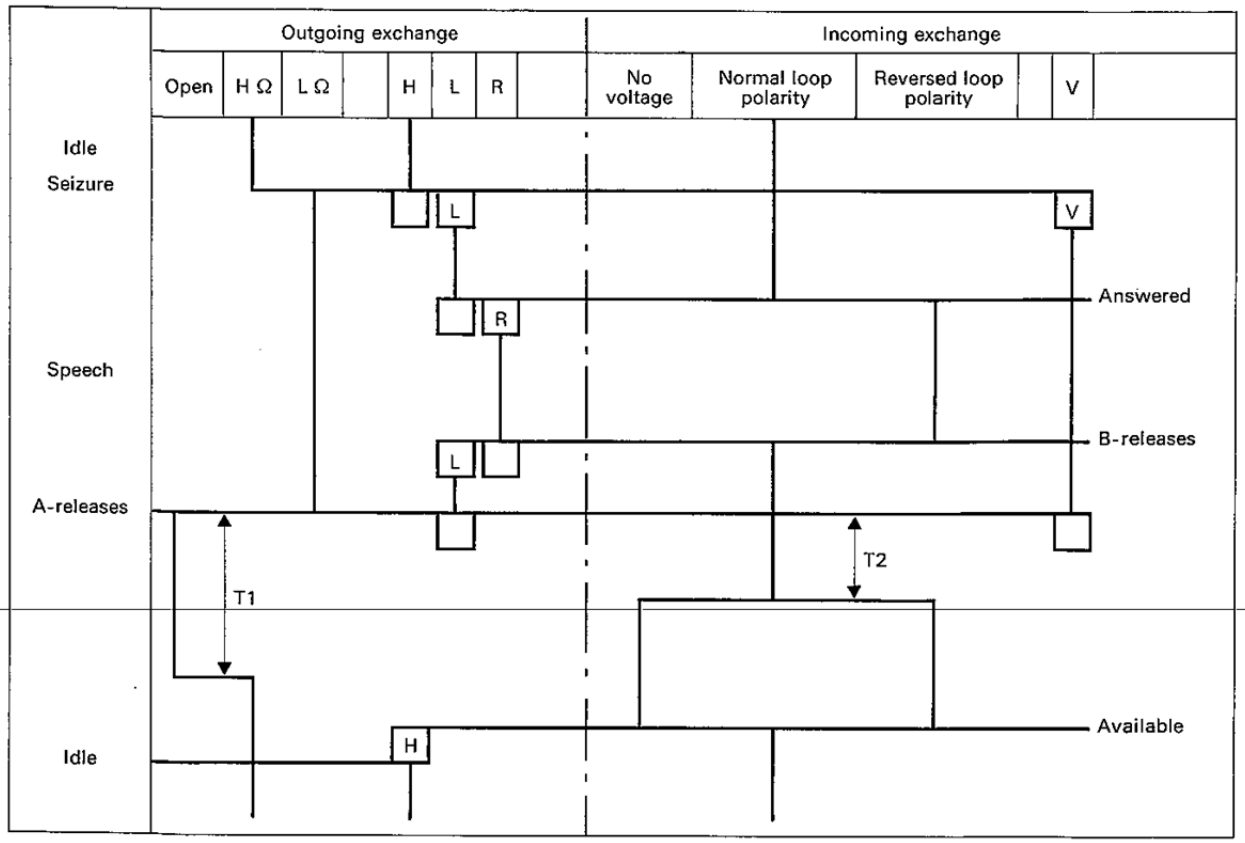

b) B-subscriber releases first (without metering)

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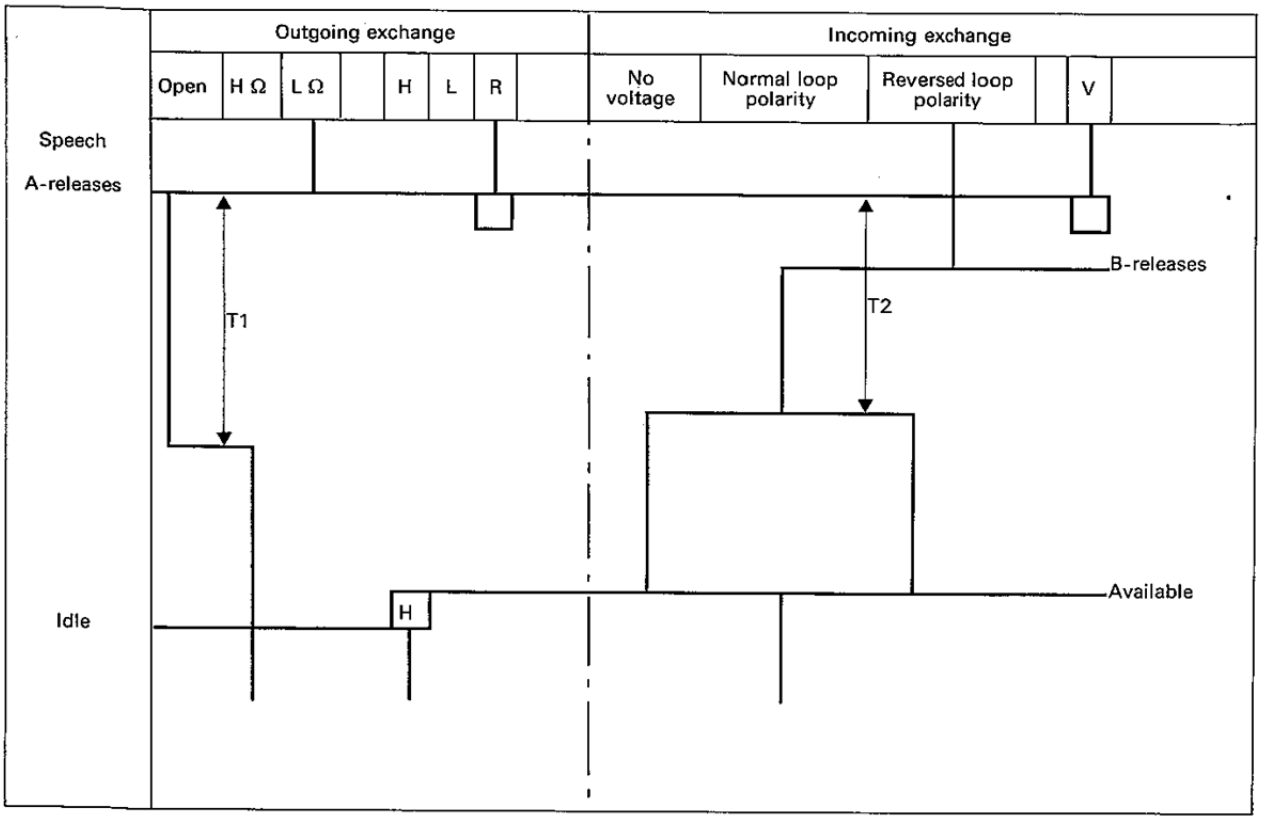
Note – In Figure 2 a square with a letter in it means the operation of the indicated detector while a square only means the release of that detector. A thick vertical line means that the related condition is there or that a detector is operated.

FIGURE 2



c) B-subscriber releases during open loop in the outgoing exchange (without metering)

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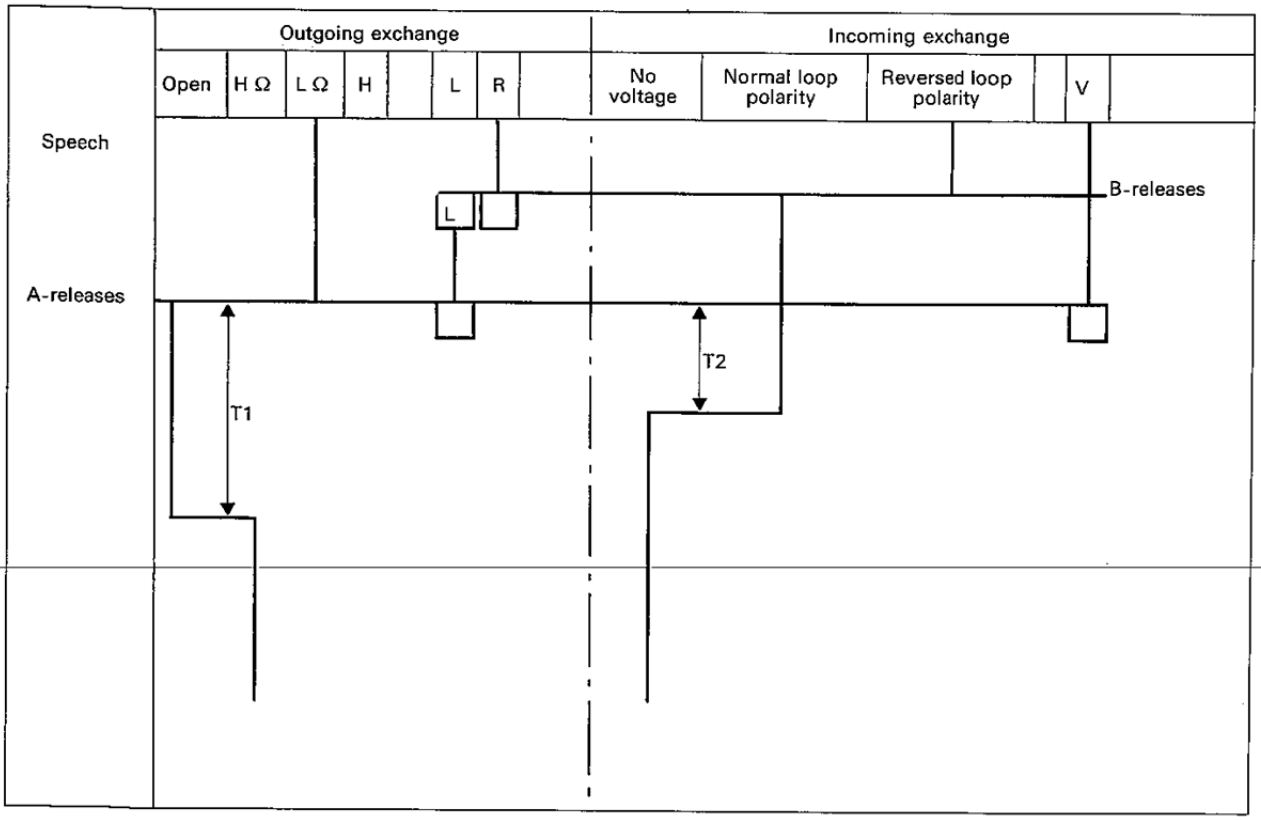

d) In-connection with subscriber releasing the incoming exchange blocks by means of open loop (without metering)

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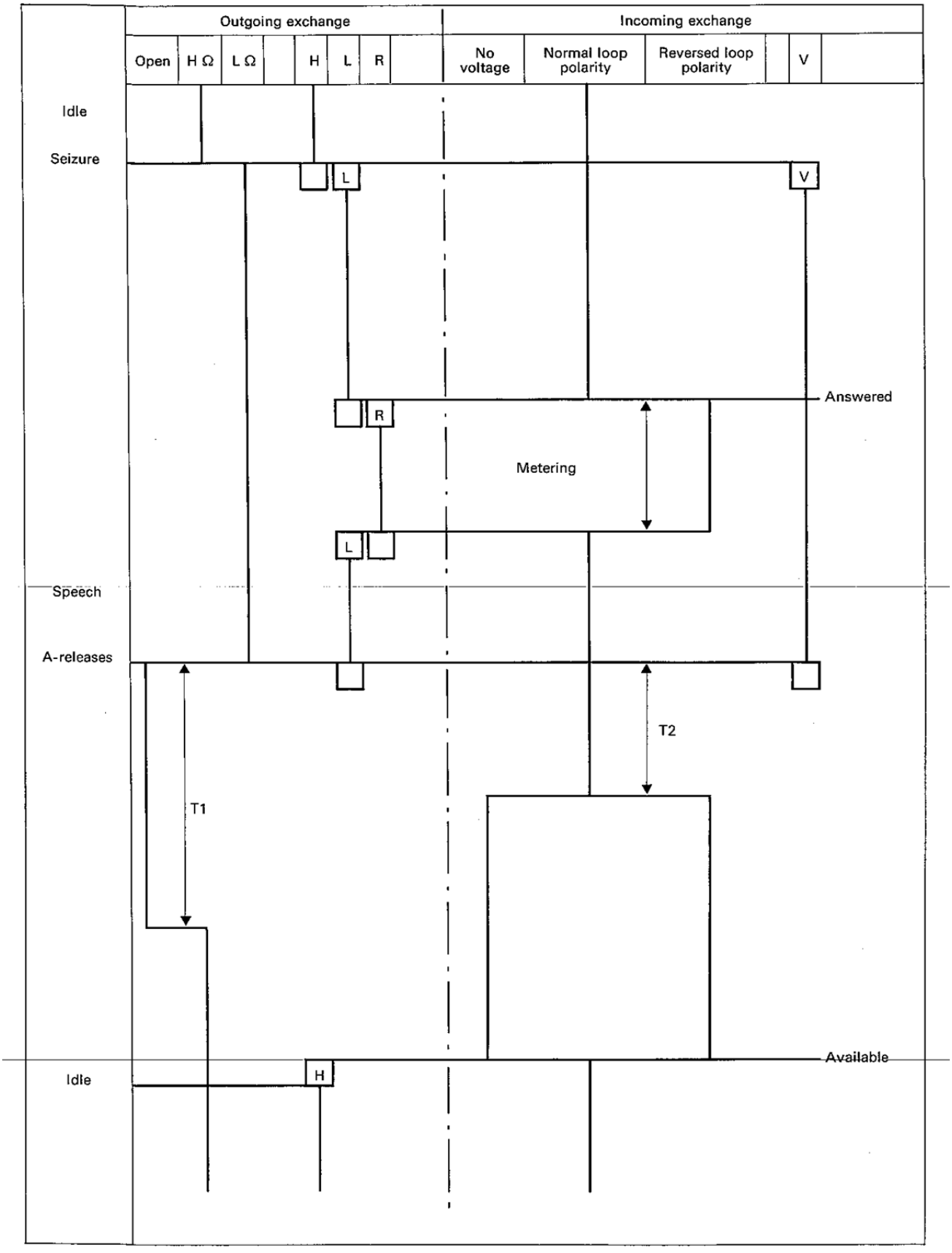
FIGURE 2 (*continued*)



e) Signalling procedure without forced release (with metering)

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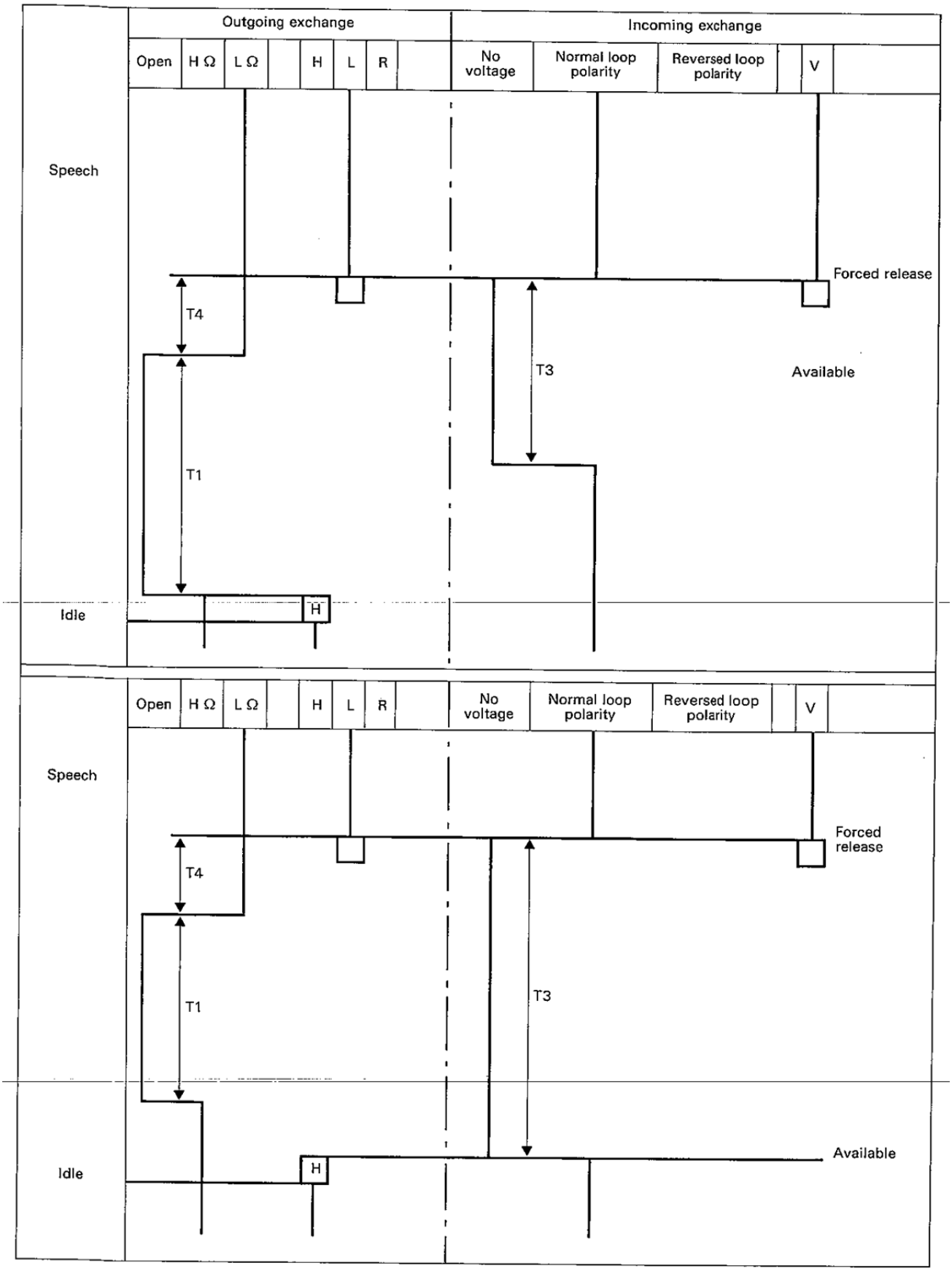
FIGURE 2 (*continued*)



f) Signalling procedure with forced release (with metering)

FIGURE 2 (*end*)

6 Time requirements

6.1 *Recognition times*

a) When the outgoing exchanges is in the idle state but blocked the recognition time of the unblocking condition (normal loop polarity) must be 100-300 ms.

b) In order to make a clear distinction between the reversal of the polarity and no voltage the recognition time of forced release must be 60-180 ms.

c) The recognition time of all remaining conditions must be 10-40 ms.

6.2 *Release times*

a) The time T2 depends on the recognition time of detector V and the reaction time of the incoming exchange which can be assumed ≤ 30 ms; consequently the time T2 is defined 10-70 ms.

b) Without metering

The worst case when releasing a circuit occurs if the B-subscriber releases just after the A-subscriber releases, causing clear-back to be sent before the recognition time of clear-forward has elapsed. In order to safeguard the operation in that particular situation the time T1 is defined 300-600 ms.

c) With metering

The worst case when releasing a circuit occurs if within the recognition time of clear-forward a metering pulse starts and that within the length of this pulse clear-forward cannot be recognized. In order to safeguard the operation in that particular situation the time T1 is defined 500-1000 ms.

The time T3 depends on the discharge time of the involved circuit and the time T4. For the discharge time, a time ≤ 80 ms can be assumed. The time T4 depends on the recognition time of forced release [see § 6.1 b)] and the reaction time of the outgoing exchange which can be assumed ≤ 30 ms; consequently the time T4 is defined 60-210 ms. Addition of these times leads to a time T3 ≥ 300 ms.

6.3 *Sending times*

The length of the metering pulse to be sent shall be 120-180 ms.

7 Miscellaneous

This supplement does not describe values for the impedance of the detectors and the cable and does not indicate operate/nonoperate limits for the detectors, because these parameter are rather dependent on the capabilities of the related network. Therefore these requirements must be provided by each Administration.

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